CLAIMS

1. A distribution optical fiber sensor system, comprising:

an optical fiber for sensing to be placed on an object to be measured,

a light source for emitting a first pulse light having a pulse width longer than a transient response of an acoustic phonon and emitting a second pulse light in succession to the first pulse after a time interval during which the vibration of the acoustic phonon is substantially maintained to supply the first and second pulse lights to the optical fiber,

a detector for detecting a scattering gain spectrum of a Brillouin-scattered light created in the optical fiber by the second pulse light at time intervals corresponding to twice the time obtained by equally dividing the pulse width of the second pulse light, and

a calculator for calculating a distortion and/or a temperature based on the respective scattering gain spectra at the respective time intervals for small sections of the optical fiber corresponding to the respective scattering gain spectra at the respective time intervals.

2. A distribution optical fiber sensor system according to claim 1, wherein the detector includes:

an optical coupler for multiplexing a light of a specified frequency and the Brillouin-scattered light from the optical fiber,

a light receiver for receiving and photoelectrically converting a light outputted from the optical coupler,

an oscillator for oscillating an electrical signal of a specified frequency,

a mixer for multiplexing an output of the light receiver and an output of the oscillator,

a band-pass filter for passing an output of the mixer within a specified frequency band,

a buffer for saving an output of the band-pass filter, and

a controller for sweeping a specified frequency of the oscillator within such a range where the scattering gain spectra can be obtained.

3. A distribution optical fiber sensor system according to claim 2, wherein the detector further includes an interpolating device for interpolating data between two outputs using the two outputs of the band-pass filter saved in the buffer.

4. A distribution optical fiber sensor system according to claim 1, wherein the detector includes:

an optical coupler for multiplexing a light of a specified frequency and the Brillouin-scattered light from the optical fiber,

a light receiver for receiving and photoelectrically converting a light outputted from the optical coupler,

a band-pass filter for passing an output of the light receiver within a specified frequency band, and

a time-frequency analyzer for applying a time-frequency analysis to an output of the band-pass filter.

5. A distribution optical fiber sensor system according to claim 1, wherein the detector includes:

an incidence device for causing a light of a specified frequency to be so incident on the optical fiber as to face the second pulse light,

an optical coupler for multiplexing the light of the specified frequency and the Brillouin-scattered light from the optical fiber,

a light receiver for receiving and photoelectrically converting a light outputted from the optical coupler,

a band-pass filter for passing an output of the light receiver within a specified frequency band, and

a controller for sweeping the specified frequency of the light within such a range where the scattering gain spectra can be obtained.

6. A distribution optical fiber sensor system according to claim 5, wherein the detector further includes a light frequency converter for converting the frequency of the light of the specified frequency to conduct a heterodyne detection.

7. A distribution optical fiber sensor system according to claim 5, wherein the light of the specified frequency and the second pulse light interact with each other a plurality of times in the optical fiber.

8. A distribution optical fiber sensor system according to claim 7, wherein the calculator further calculates a lateral pressure acting on the object to be measured based on the respective scattering gain spectra at the respective time intervals for the respective small sections of the optical fiber corresponding to the respective scattering gain spectra at the respective time intervals.

9. A distribution optical fiber sensor system according to claim 1, wherein the detector includes:

a first optical coupler for distributing a light of a specified frequency into two lights,

an optical switch for passing or shutting off one of the lights distributed in the first optical coupler,

a second optical coupler for multiplexing a light from the optical switch and a Brillouin-scattered light from the optical fiber, distributing the multiplexed light into two lights, and causing one of the distributed lights to be incident on the optical fiber,

a third optical coupler for multiplexing the other of the lights distributed in the first optical coupler and the other of the lights distributed in the second light coupler,

a light receiver for receiving and photoelectrically converting a light outputted from the third optical coupler,

a band-pass filter for transmitting an output of the light receiver within a specified frequency band, and

a time-frequency analyzer for applying a time-frequency analysis to an output of the band-pass filter.